



Armed Forces College of Medicine

AFCM



The Cerebellum

Anatomy and (Histology)

By

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Histology)**

INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

- **Identify surfaces and major fissures of cerebellum.**
- **Classify the cerebellum into lobes anatomically and functionally.**
- **Enumerate arteries supplying cerebellum.**
- **List the layers of the cerebellar cortex and the cells forming them.**
- **Describe microscopic structure of cells in different layers of the cerebellar cortex.**



Anatomy of the Cerebellum

By

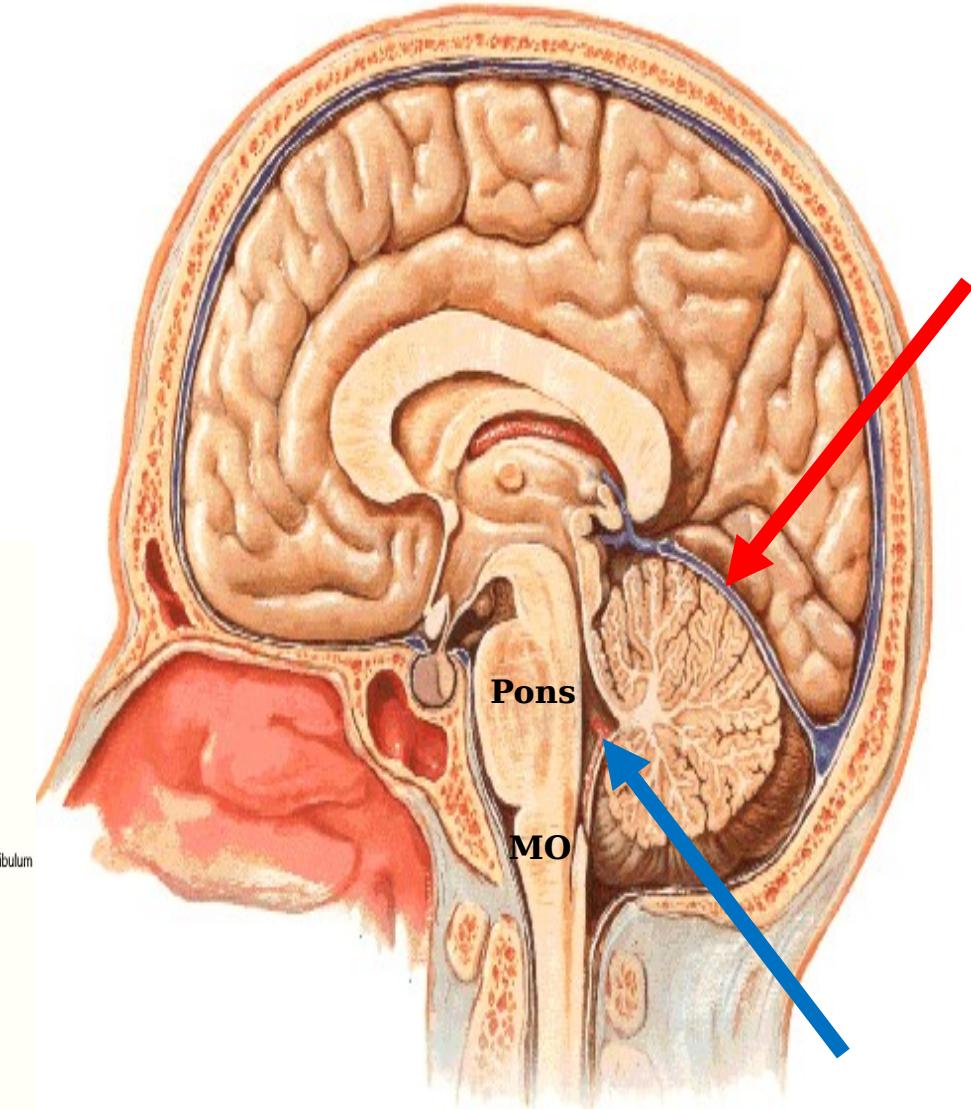
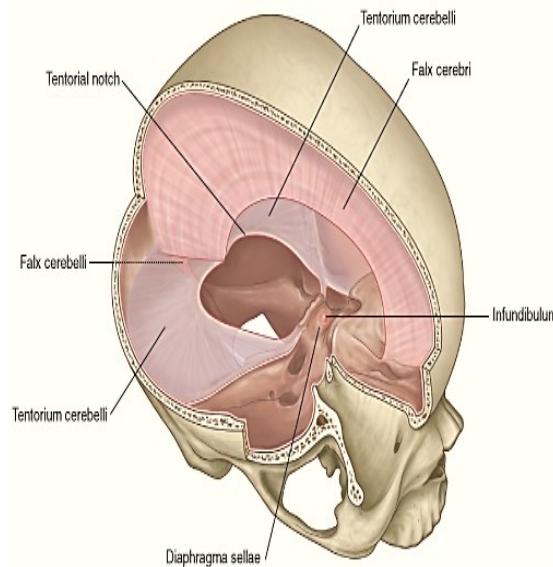
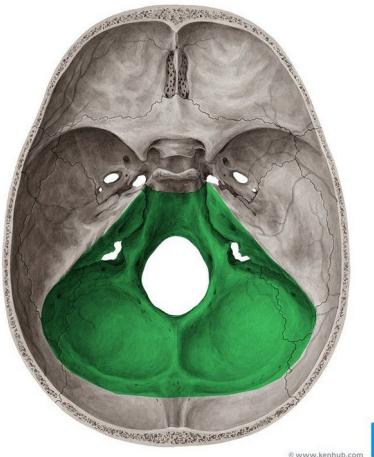
Dr. Hagar Yousry Rady

Lecturer of Anatomy and

The Cerebellum

➤ Site:

- Lies in the posterior cranial fossa.
- Below the tentorium cerebelli separating it from the cerebrum.
- It lies posterior to the pons and medulla with

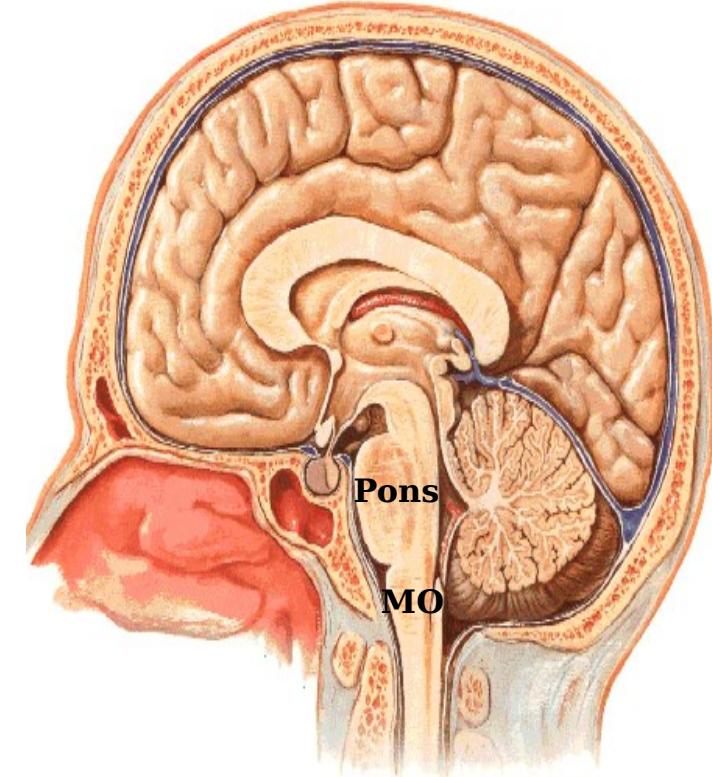
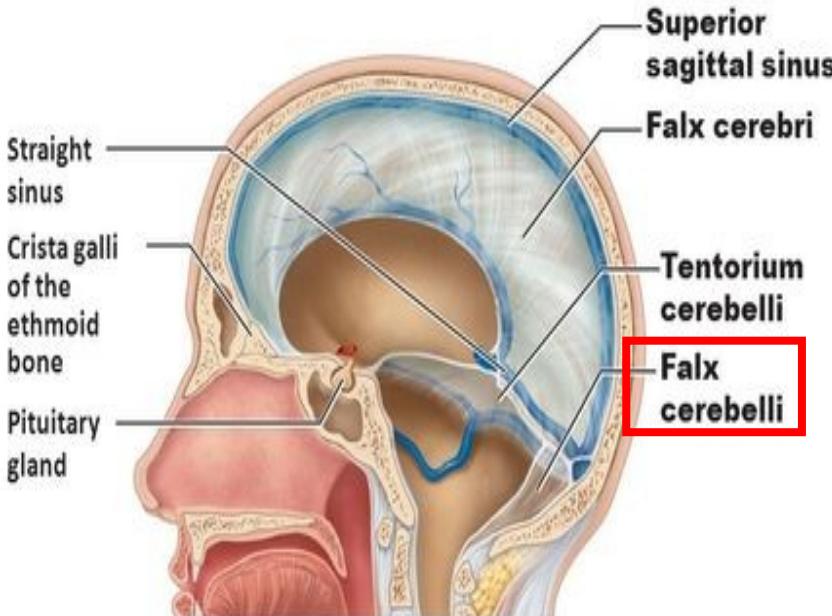
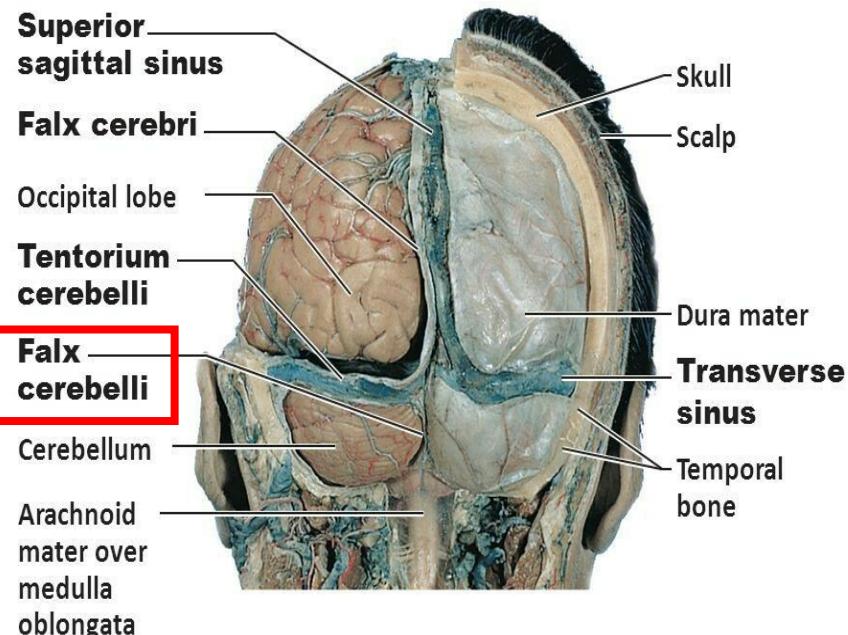
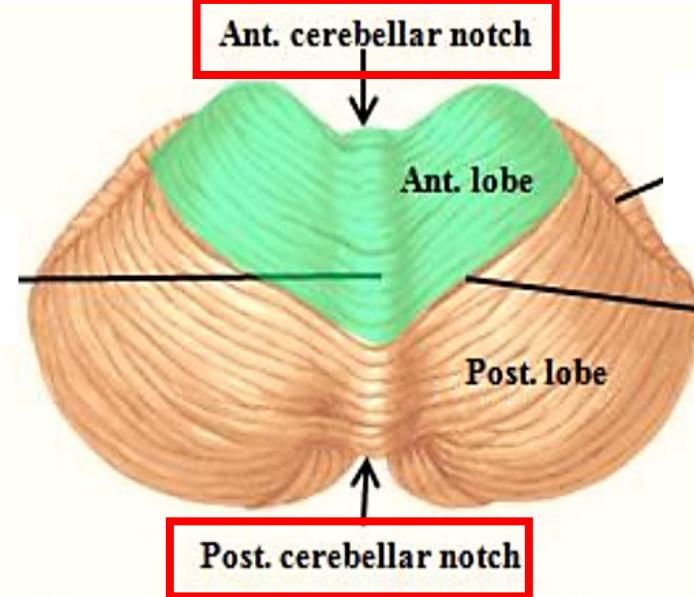


The Cerebellum

➤ It has 2 notches:

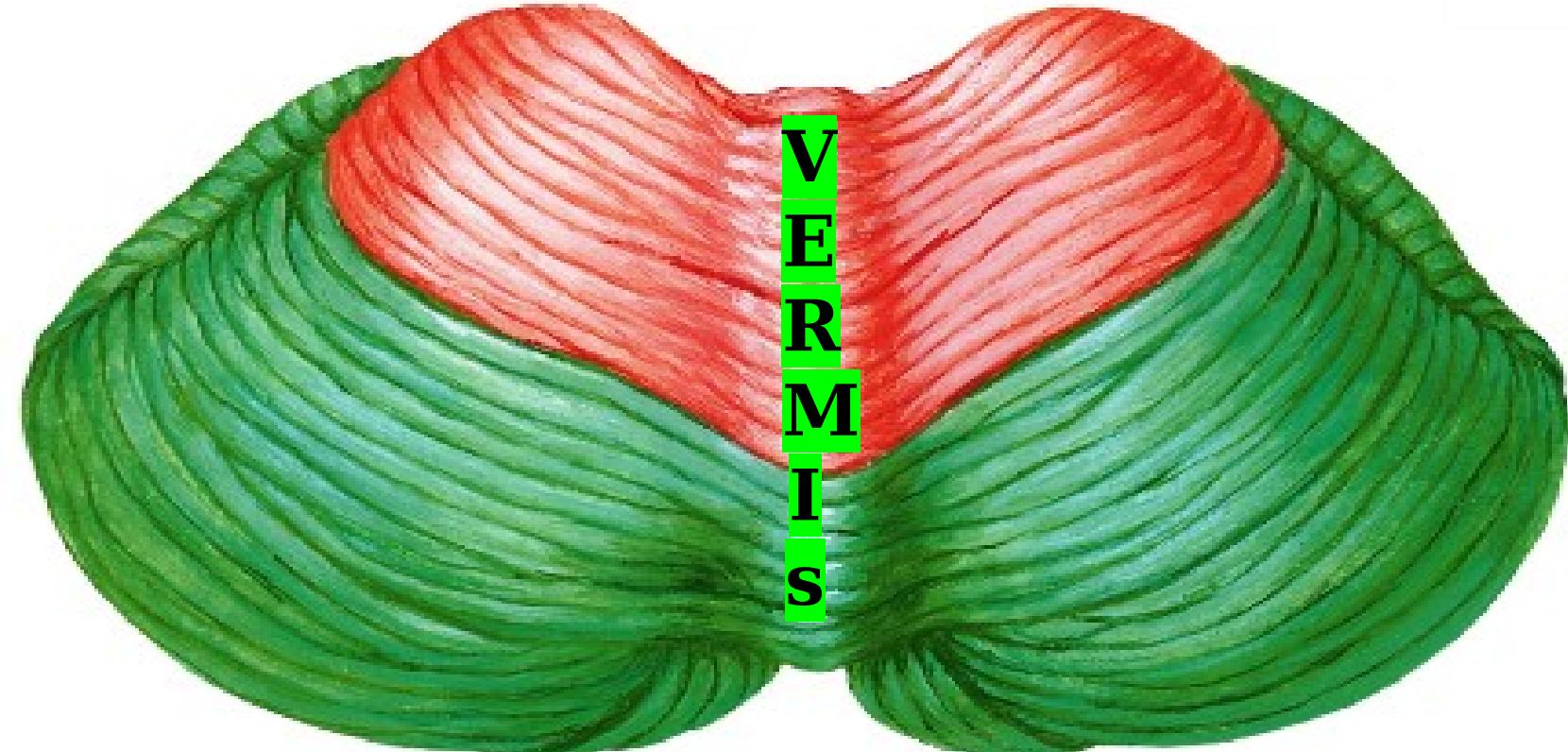
1- Anterior notch which lodges the pons and medulla.

2- Posterior notch that lodges the falx



The Cerebellum

It is formed of 2 cerebellar hemispheres joined by a median narrow part, the vermis.

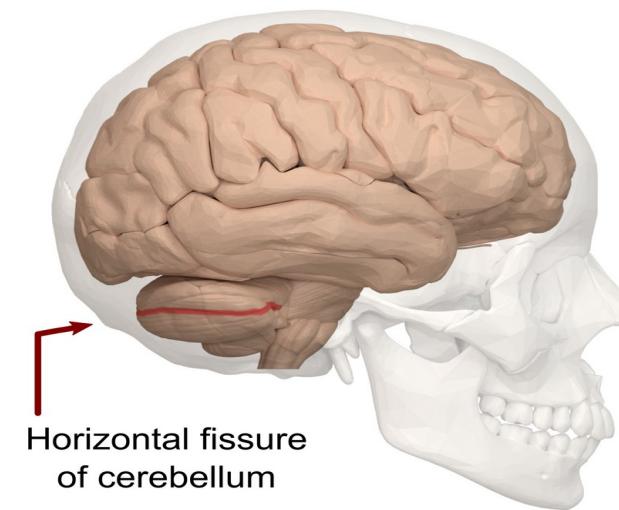


The Cerebellum

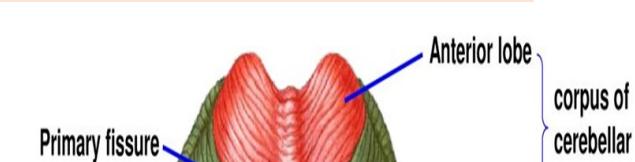
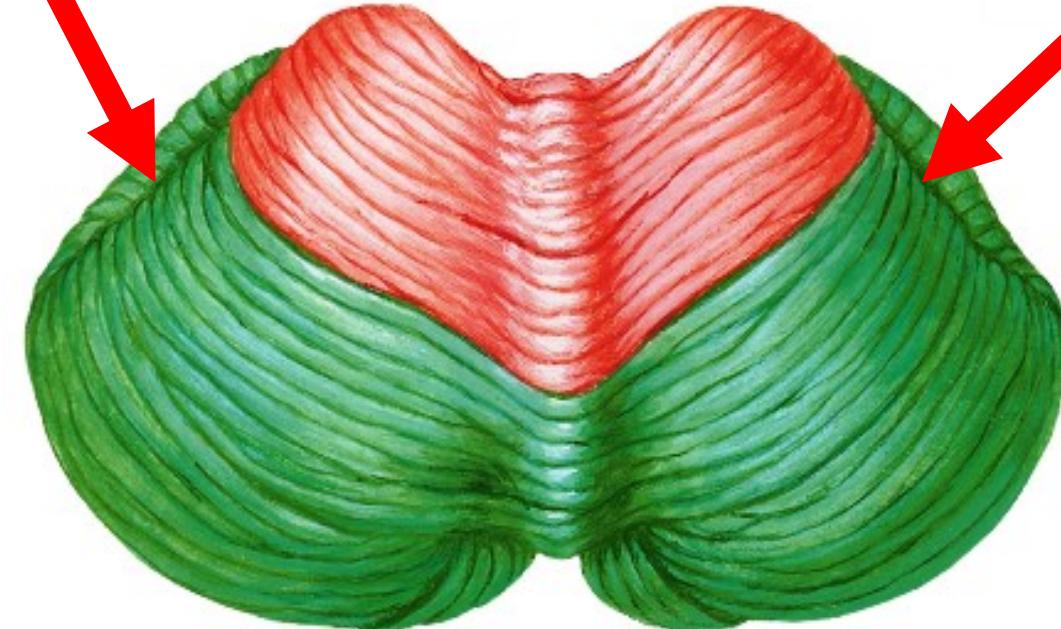
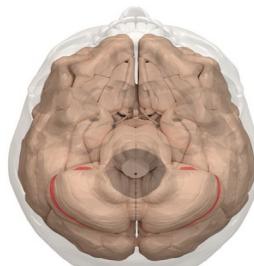
The surface of the cerebellum shows many fissures.

A deep fissure, the horizontal fissure, lies along the margin of the cerebellum and separates the superior from the inferior

surface.



Horizontal fissure
of cerebellum

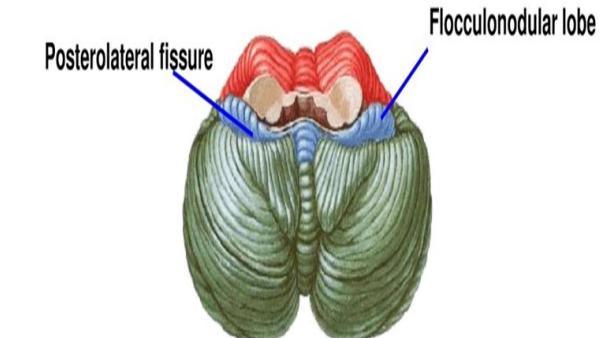


Primary fissure

Anterior lobe

Posterior lobe

corpus of cerebellar



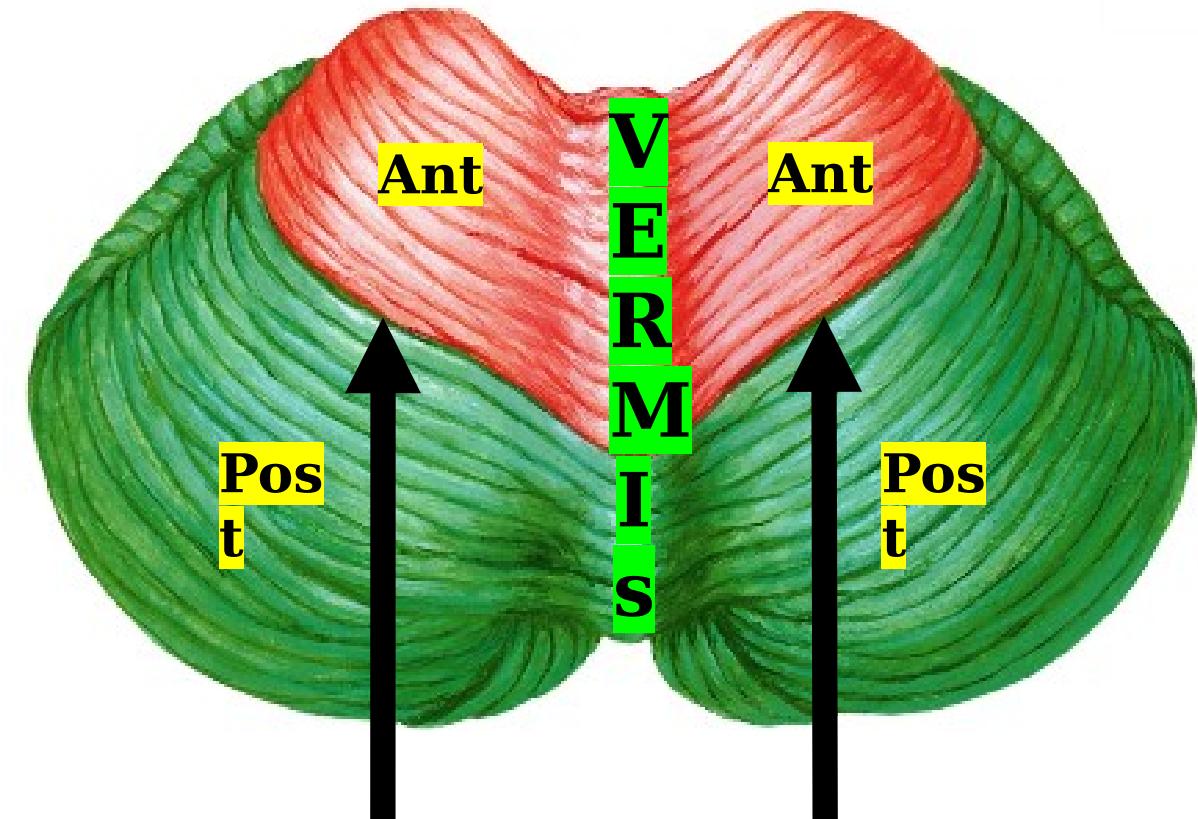
Posterolateral fissure

Flocculonodular lobe

Surfaces of the Cerebellum

I. Superior Surface:

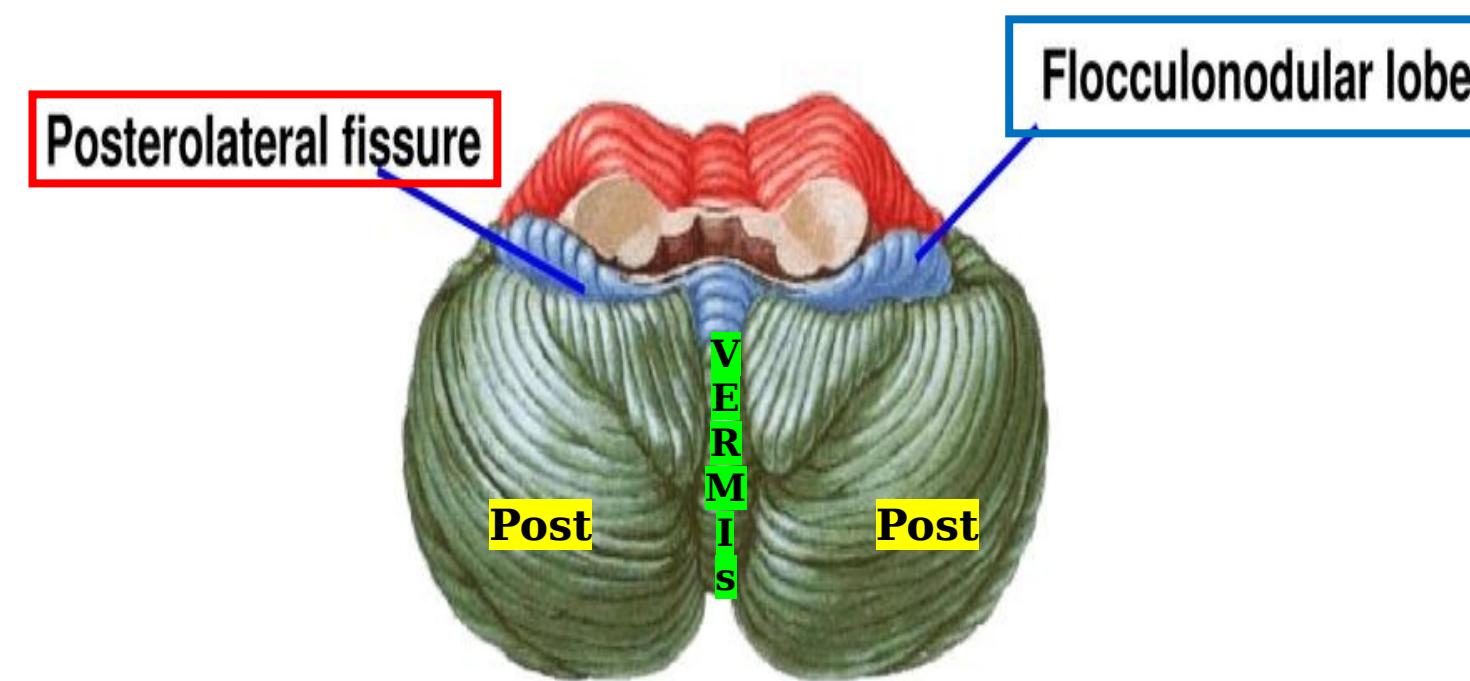
- It shows the superior vermis raised more than the cerebellar hemispheres.
- It shows a deep fissure, Primary fissure, that separates anterior lobe from posterior lobe of cerebellum.



Surfaces of the Cerebellum

II. Inferior Surface:

- The inferior vermis is present in a deep groove, vallecula that lies between the two cerebellar hemispheres.
- A posterolateral fissure separates the posterior



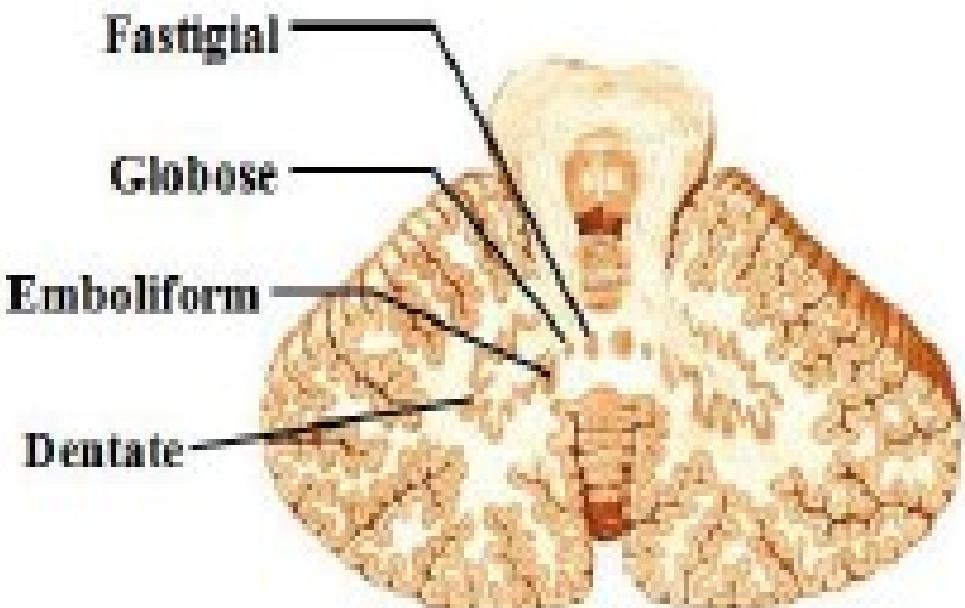
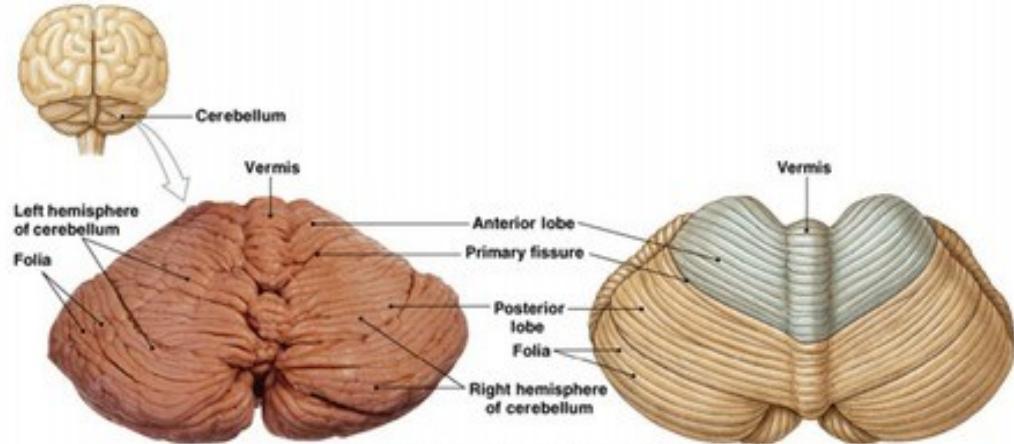
The Grey Matter of the Cerebellum

1. Cerebellar cortex (on the surface).

The cortex is folded by parallel and transverse fissures into folia.

2. Cerebellar nuclei (scattered in the white matter core).

They include the Dentate, Emboliform, Globose and Fastigial nuclei from lateral to medial.



Lobes of the Cerebellum

Anatomical Classification

1

Classification

1. Anterior lobe
2. Posterior lobe
3. Follculonodular

Functional Classification

1. Archicerebellum
2. Paleocerebellum
3. Neocerebellum

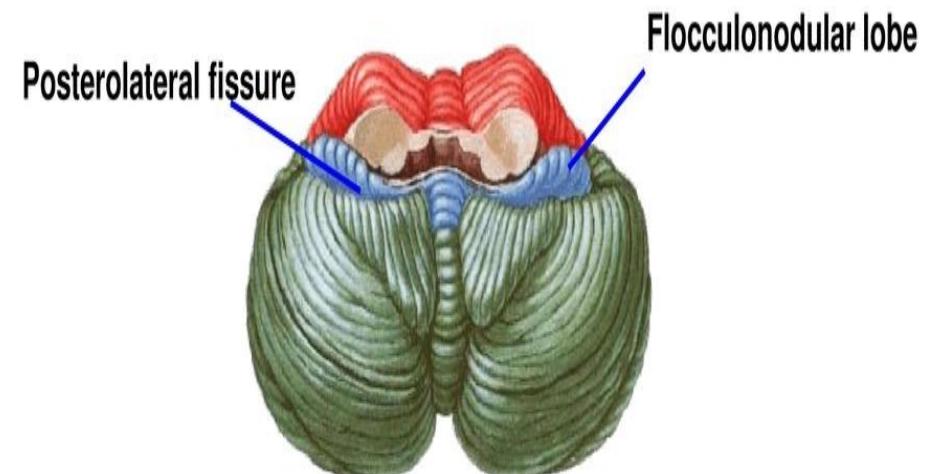
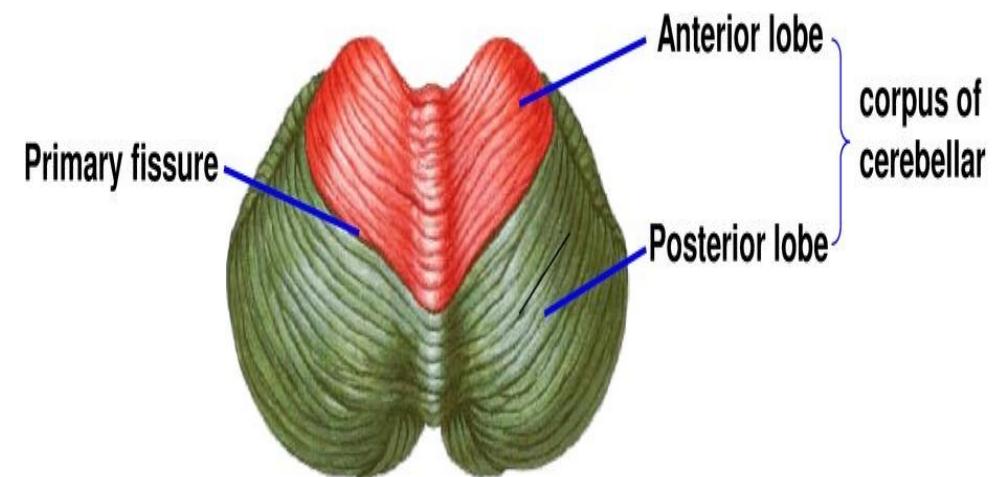
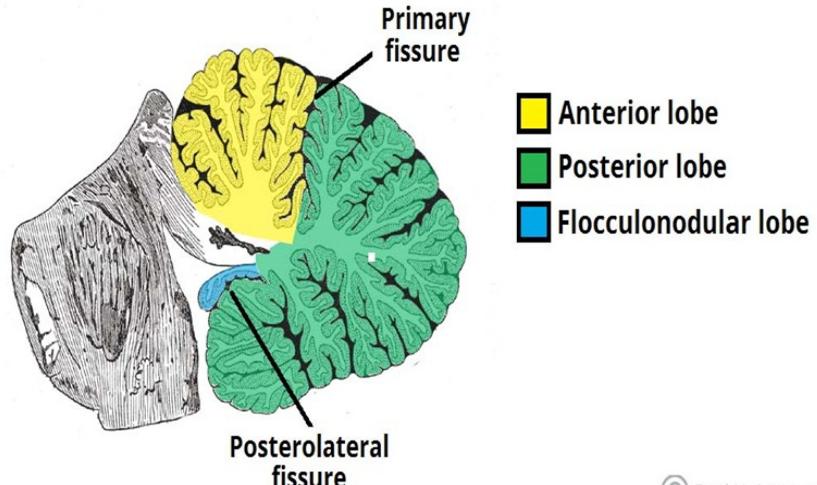
Lobes of the Cerebellum

➤ Anatomically the cerebellum is divided into 3 lobes:

1. Anterior lobe: in front of the primary fissure.

2. Posterior lobe: behind the primary fissure.

3. Flocculonodular lobe: separated from posterior



Lobes of the Cerebellum

3 main fissures

Primary

Horizontal

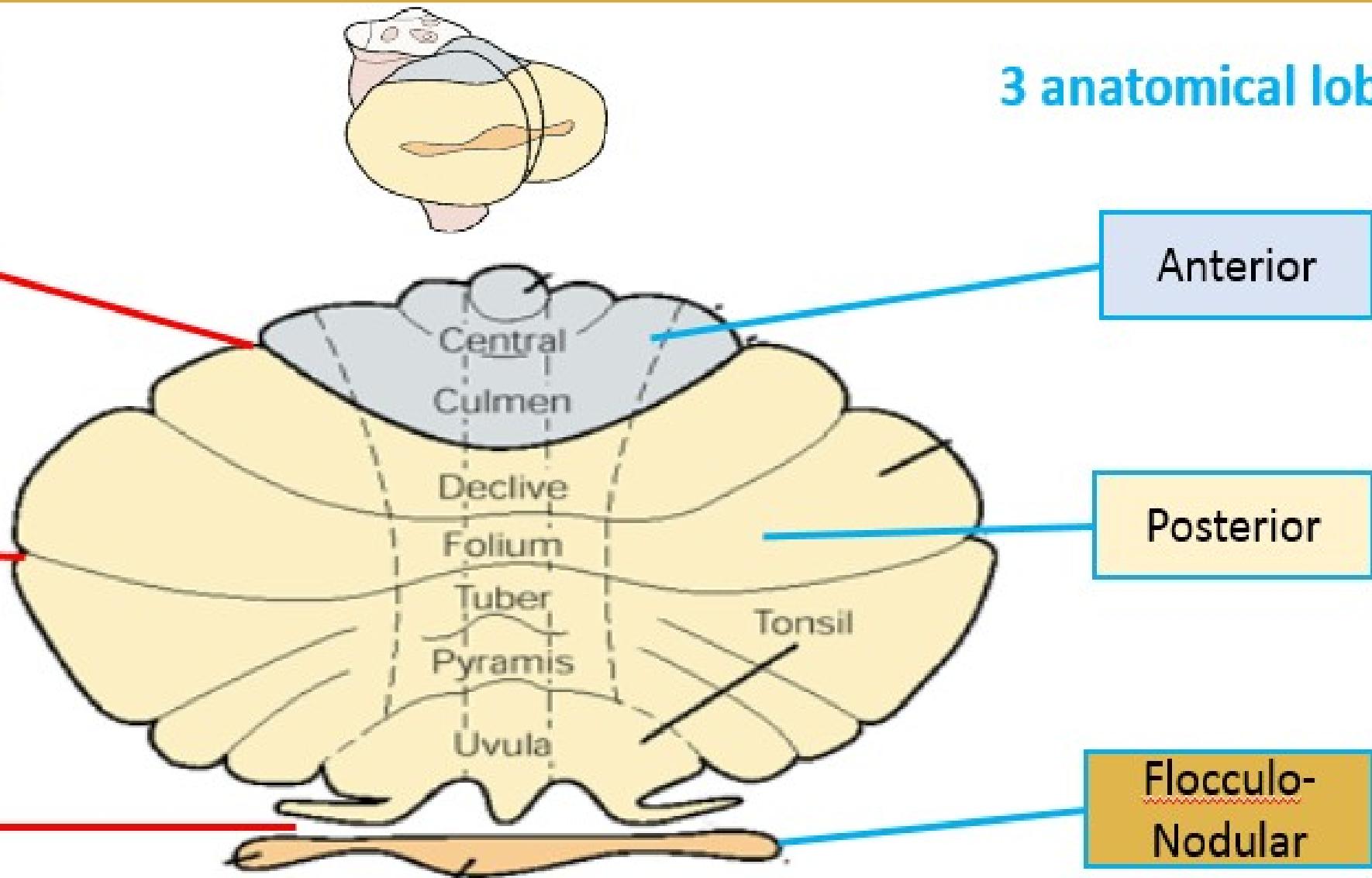
Postero-
lateral

3 anatomical lobes

Anterior

Posterior

Flocculo-
Nodular



Lobes of the Cerebellum

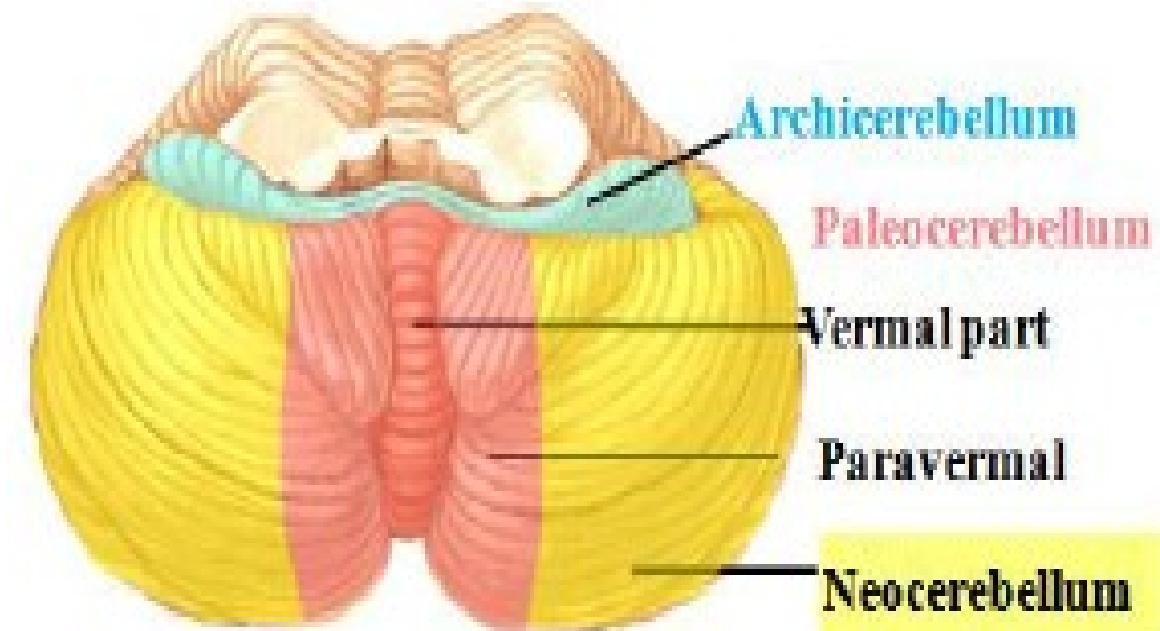
Functionally the cerebellum is divided into 3 lobes:

1. Archicerebellum:

- Its connections are vestibular.
- It is concerned with equilibrium.

- It is formed of:

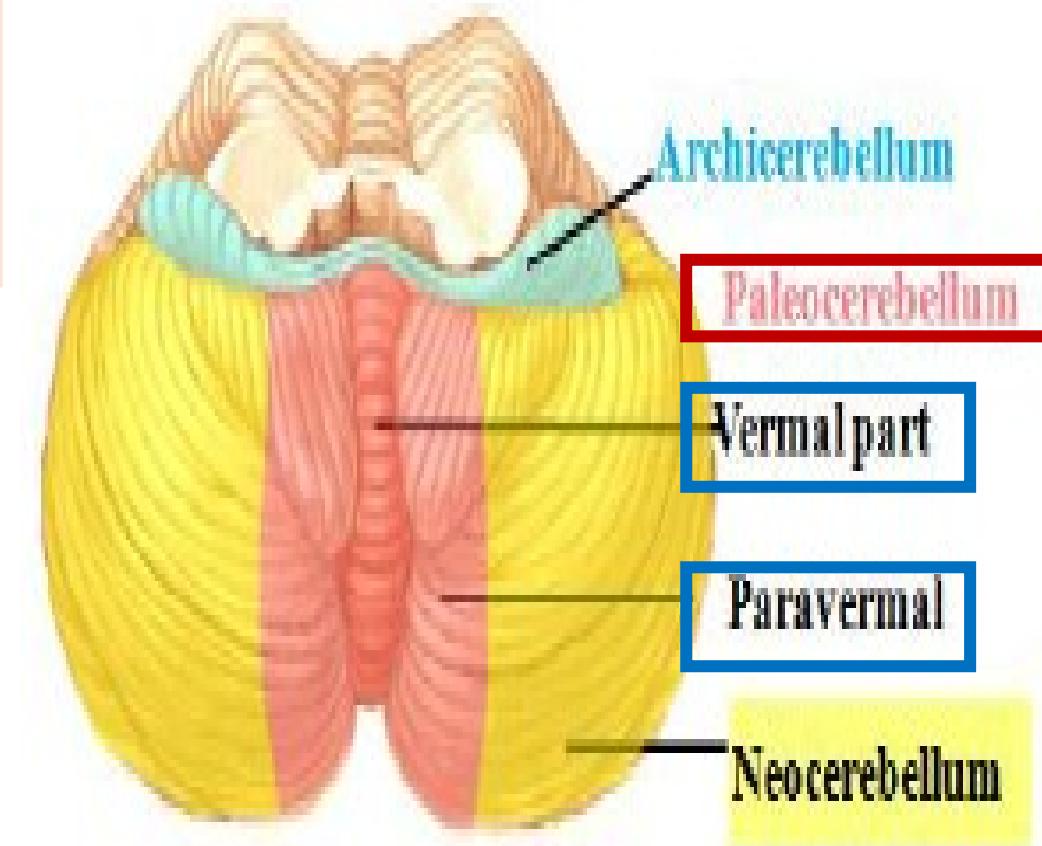
2 Flocculi + Nodule (part of inf. Vermis)



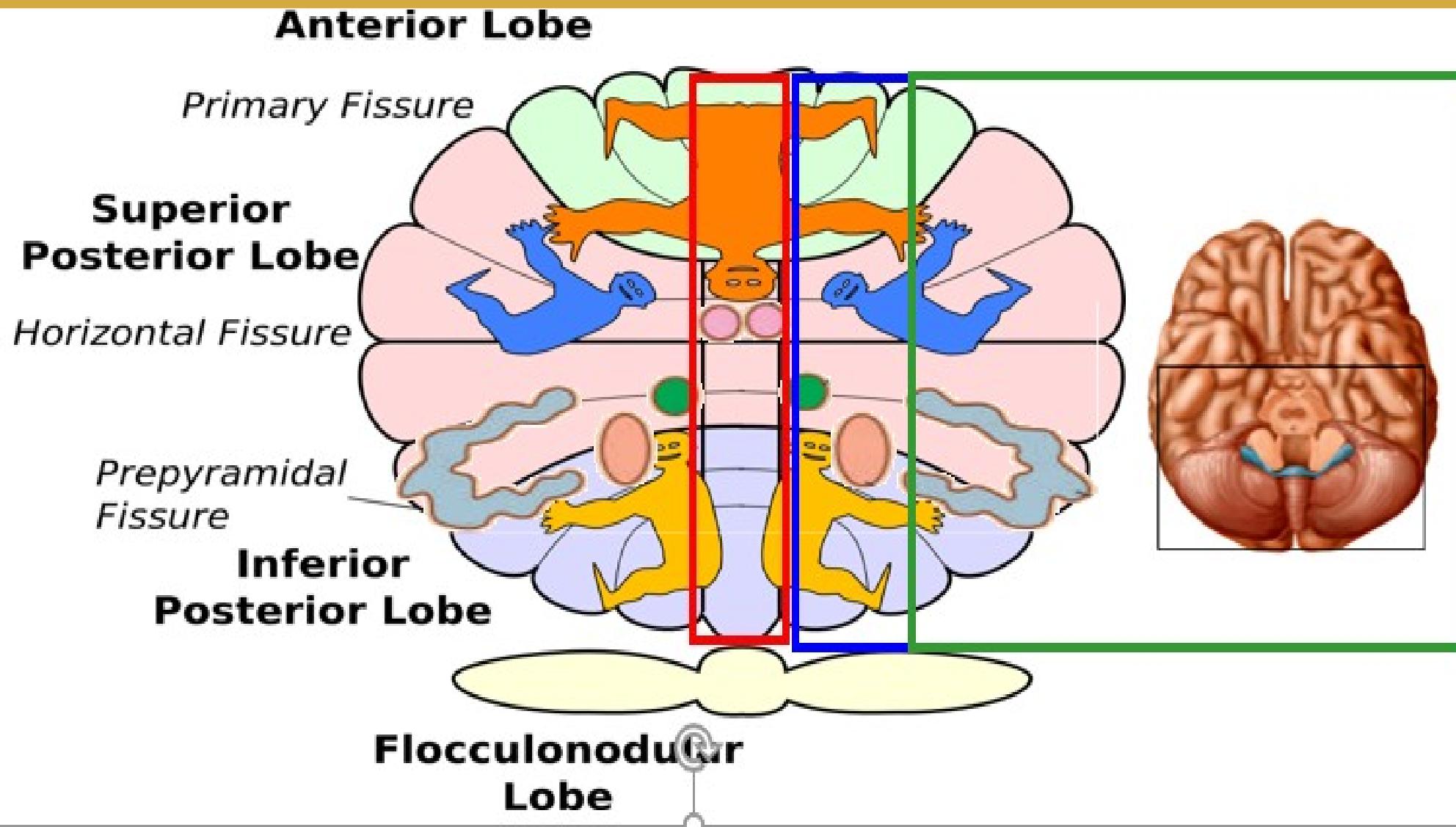
Lobes of the Cerebellum

2. Paleocerebellum

- Its connections are spinal (spinocerebellar)
- It controls muscle tone, posture &
..
- It is formed of 3 parts:
 - a. Vermal part: includes the whole vermis. It has connections to the trunk muscles of both sides via the fastigial nucleus.
 - b. 2 paravermal parts of the cerebellar hemispheres: are connected to the distal limb muscles of the same side via the globose and



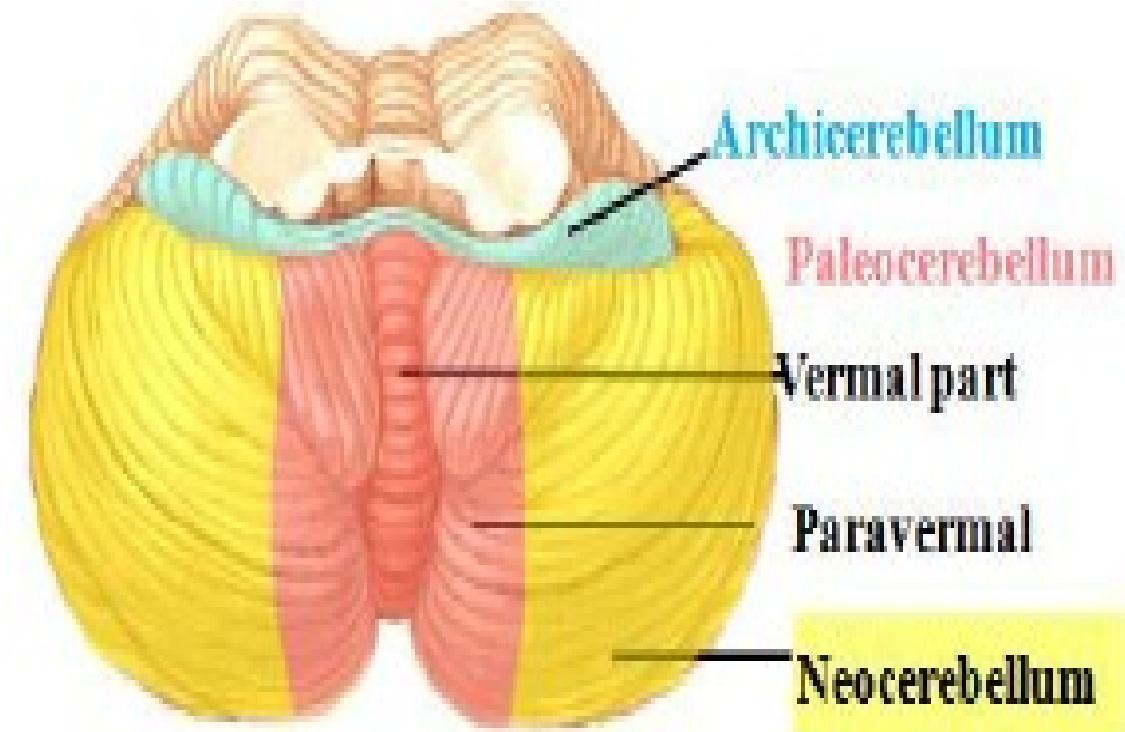
Functional Lobes of the Cerebellum



Lobes of the Cerebellum

3. Neocerebellum:

- Its connections are cortico-ponto-cerebellar & projects to the contralateral cerebral cortex via the dentate nucleus.
- It interacts with motor cortex in planning & programming movement.
- It is formed of the most lateral parts of cerebellar hemispheres.



Arterial Blood Supply of the Cerebellum

One artery to the upper surface & 2 arteries to the lower surface:

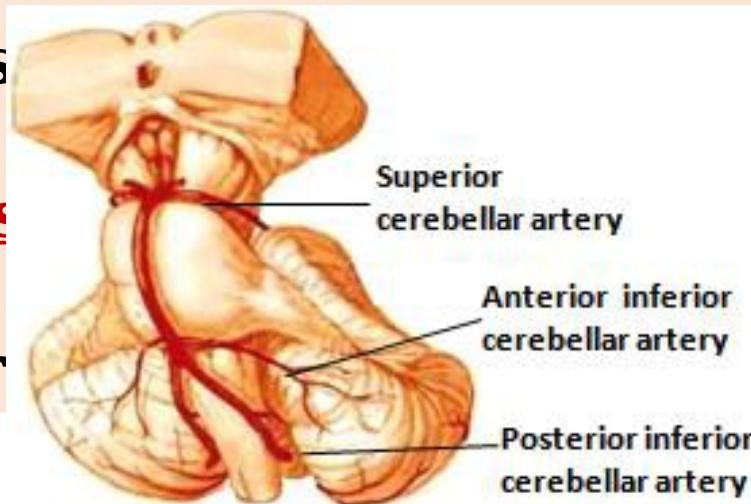
1. Superior cerebellar a. (br. of basilar)

2. Anterior-inferior cerebellar a. (br.

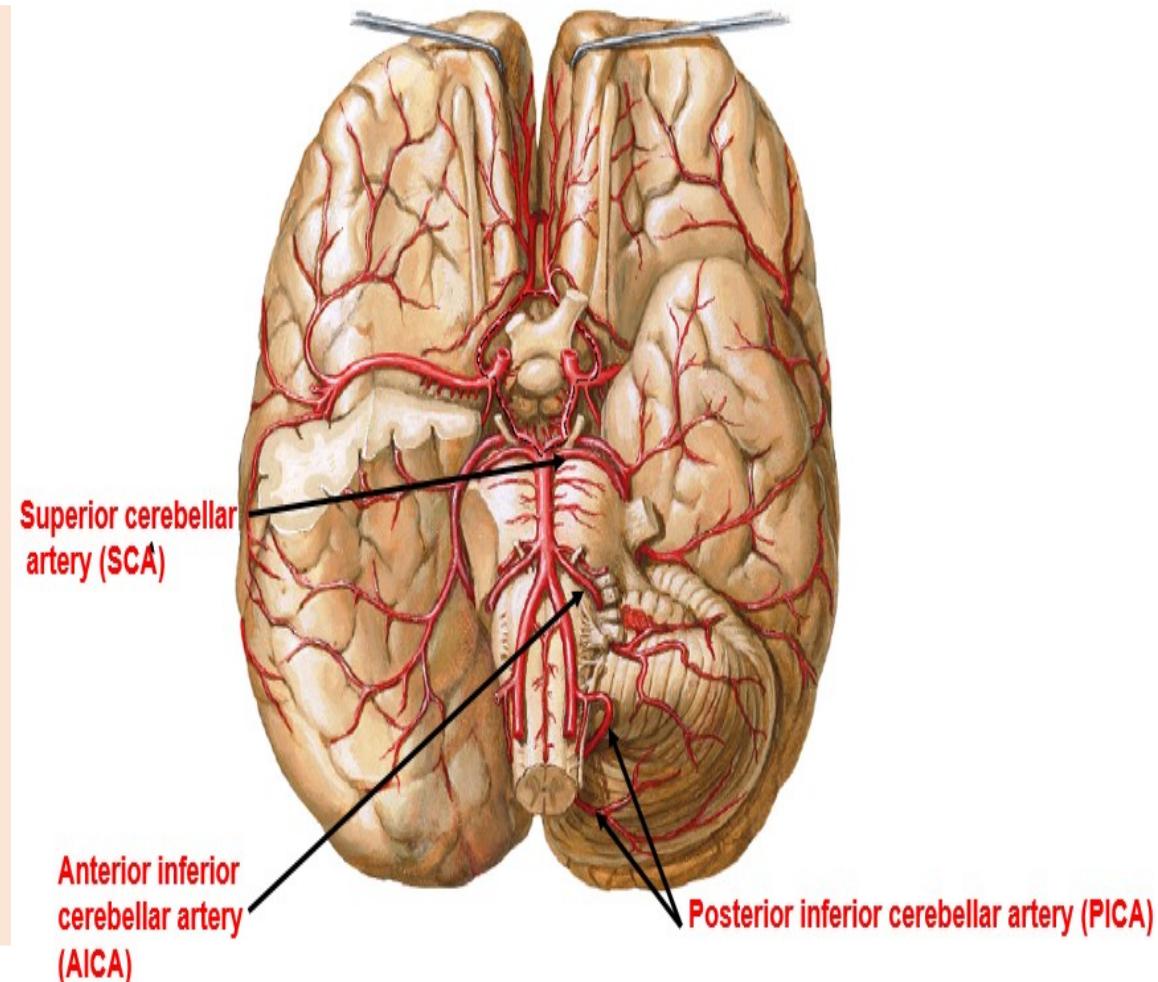
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The Cerebellar Peduncles

Three pairs of peduncles attach cerebellum to the brain

Superior - Middle - Inferior

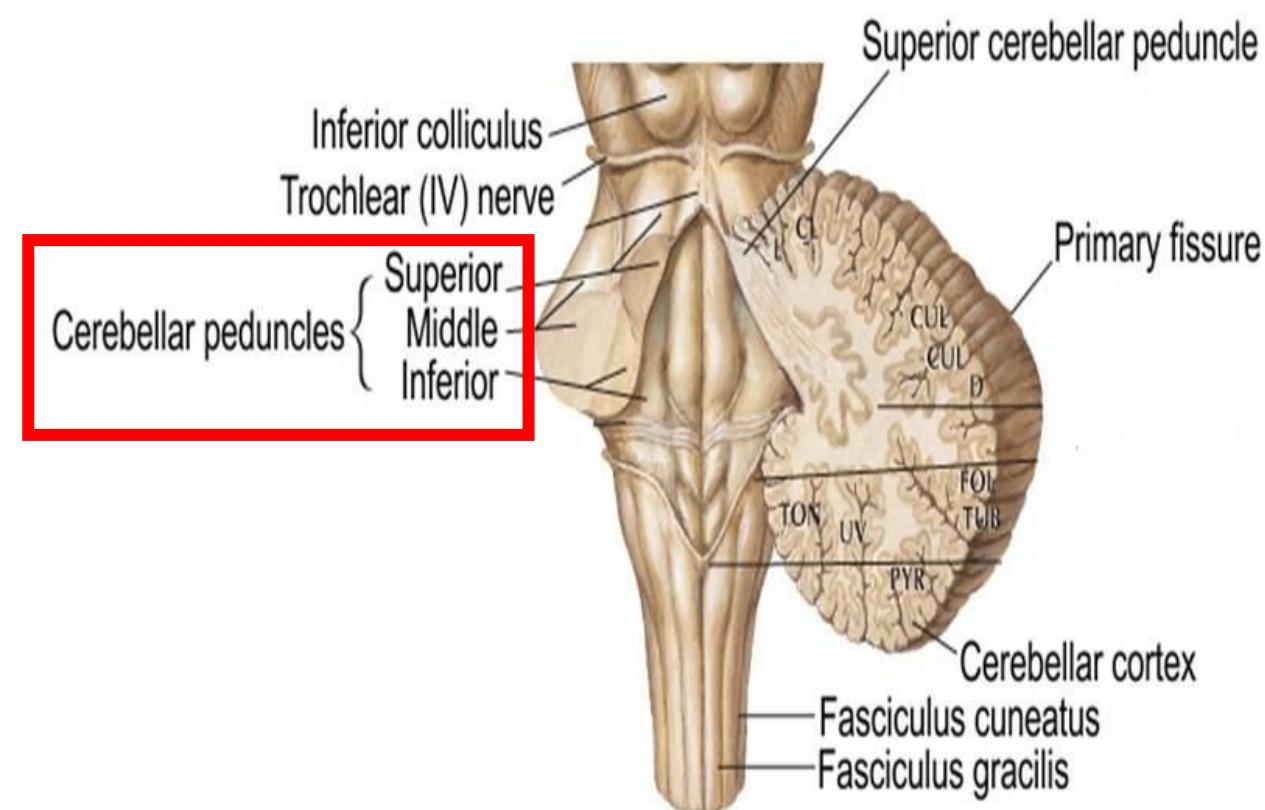
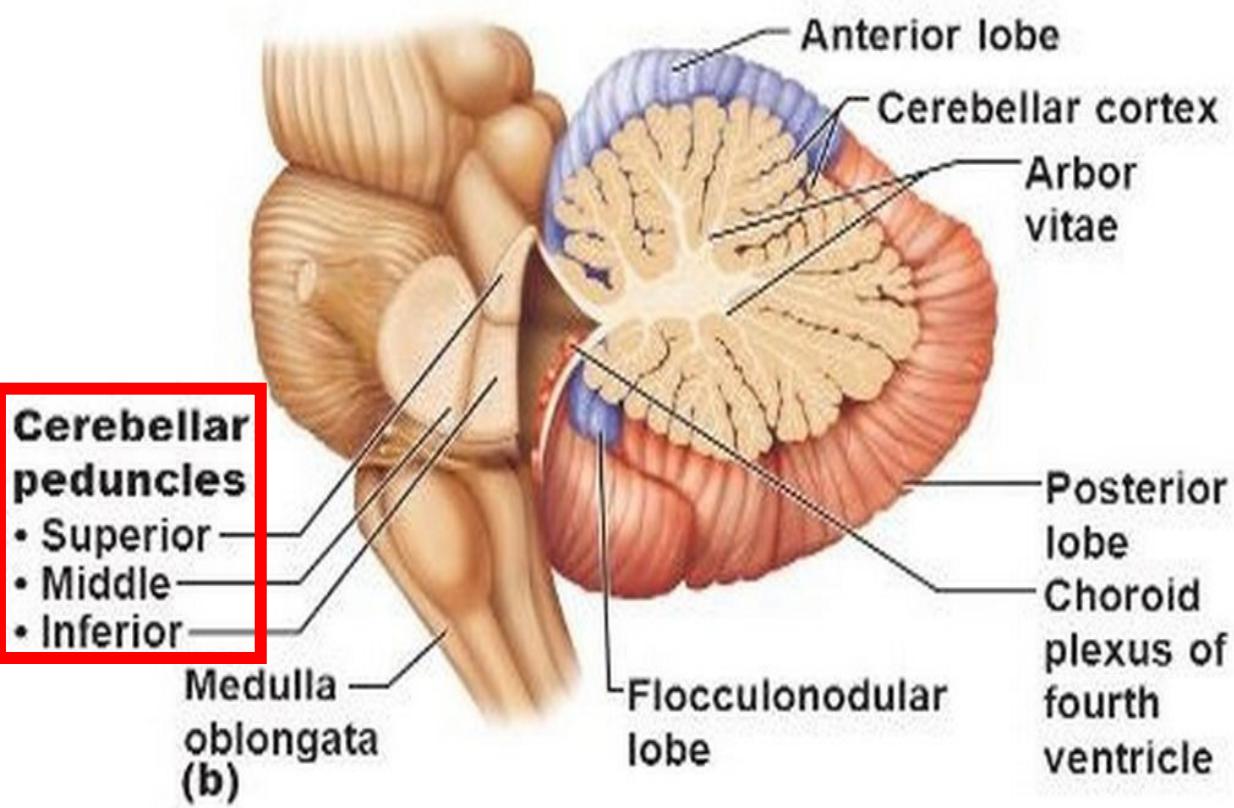


Figure 12.



Histology

Prof. Dr. Walaa Baher

Ass. Professor of Histology

Internal Structure

Histological structure of the cerebellum



Gray matter

- a) The outer cortex.
- b) Four pairs of intrinsic cerebellar nuclei.

White matter

- a) Afferent connections.
- b) Efferent connections.

The cerebellar cortex



Composed of transverse folia.

Each folium contains a core of white matter covered by a gray matter.

Molecular layer

- Stellate cells
- Basket cells

lar

Purkinje cell layer

- Purkinje cells

of t

Granular layer

- Granule cells.
- Golgi type II cells.
- Cerebellar islands (Glomeruli)

The Molecular layer

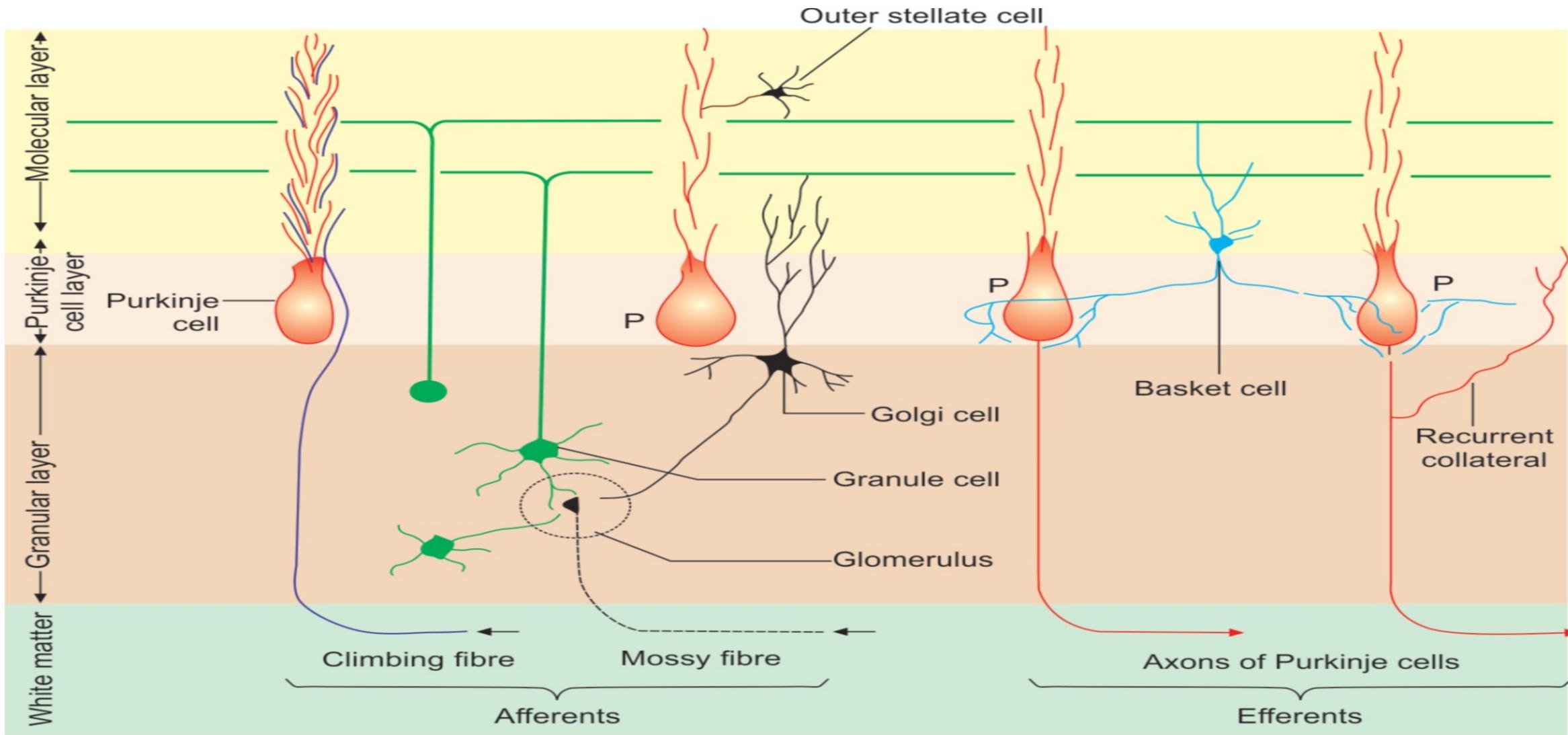


Outer most layer.

Formed of two types of cells:

| Basket cells | Stellate cells | |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------|
| Deep part of the molecular layer | Superficial part of the molecular layer | Site |
| Found in the same layer | | Dendrites |
| Form basket-like terminal arborizations around purkinje cell bodies. (a single cell makes synapse with many Purkinje cells up to 10 cells) | Pass parallel to the surface of the cerebellum, to synapse with the dendrites of purkinje cells | Axons |

The molecular layer



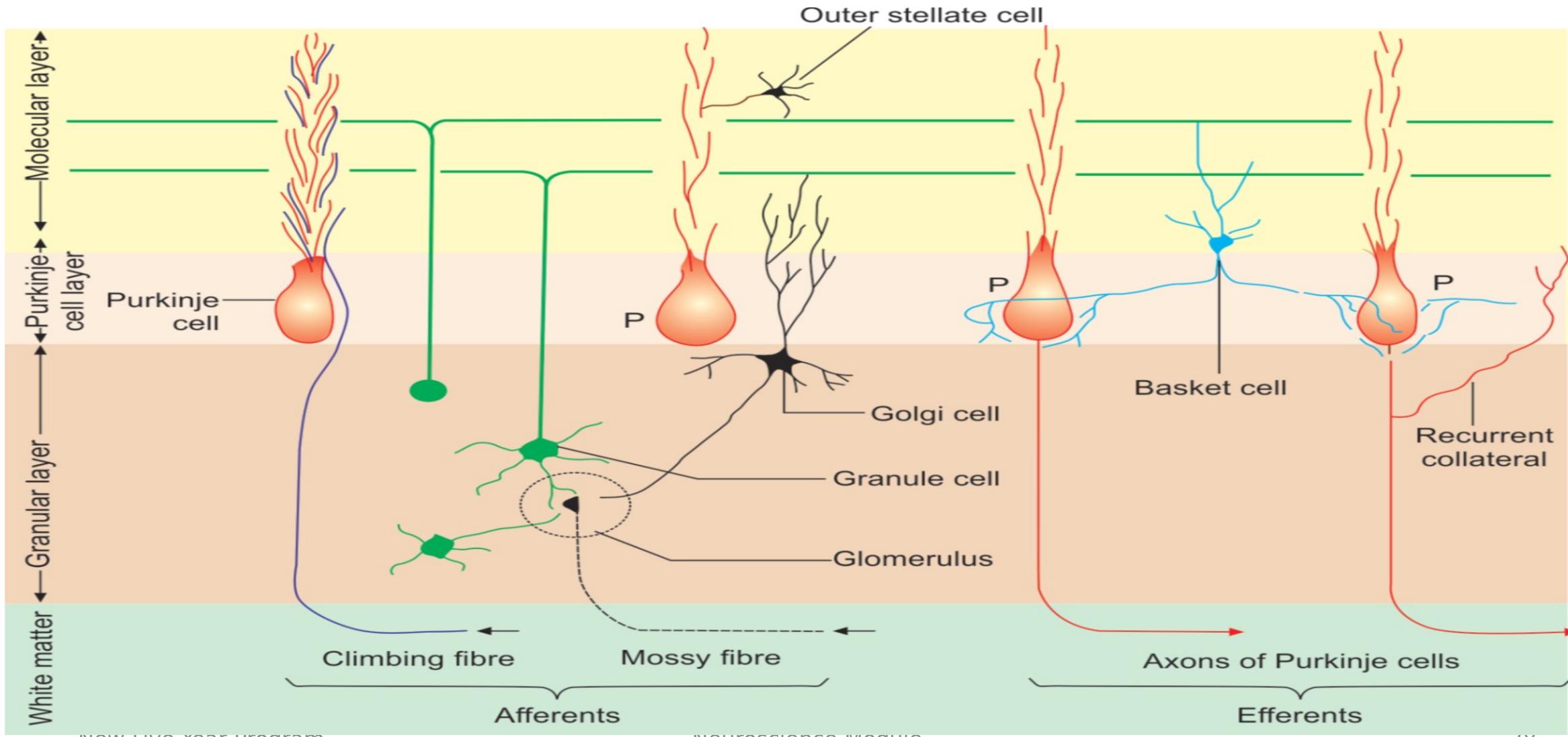
The Molecular layer



Fibers of the molecular layer:

- a) Dendritic arborizations and axons of its own cells.
- b) The dendrites of cells in the deeper layers (purkinje cells and golgi type II cells).
- c) Climbing fibers, the afferent fibers to the cerebellum.
- d) Axons of granule cells which are oriented transversely and parallel to the long axis of folia.

The molecular layer



Purkinje Cell layer

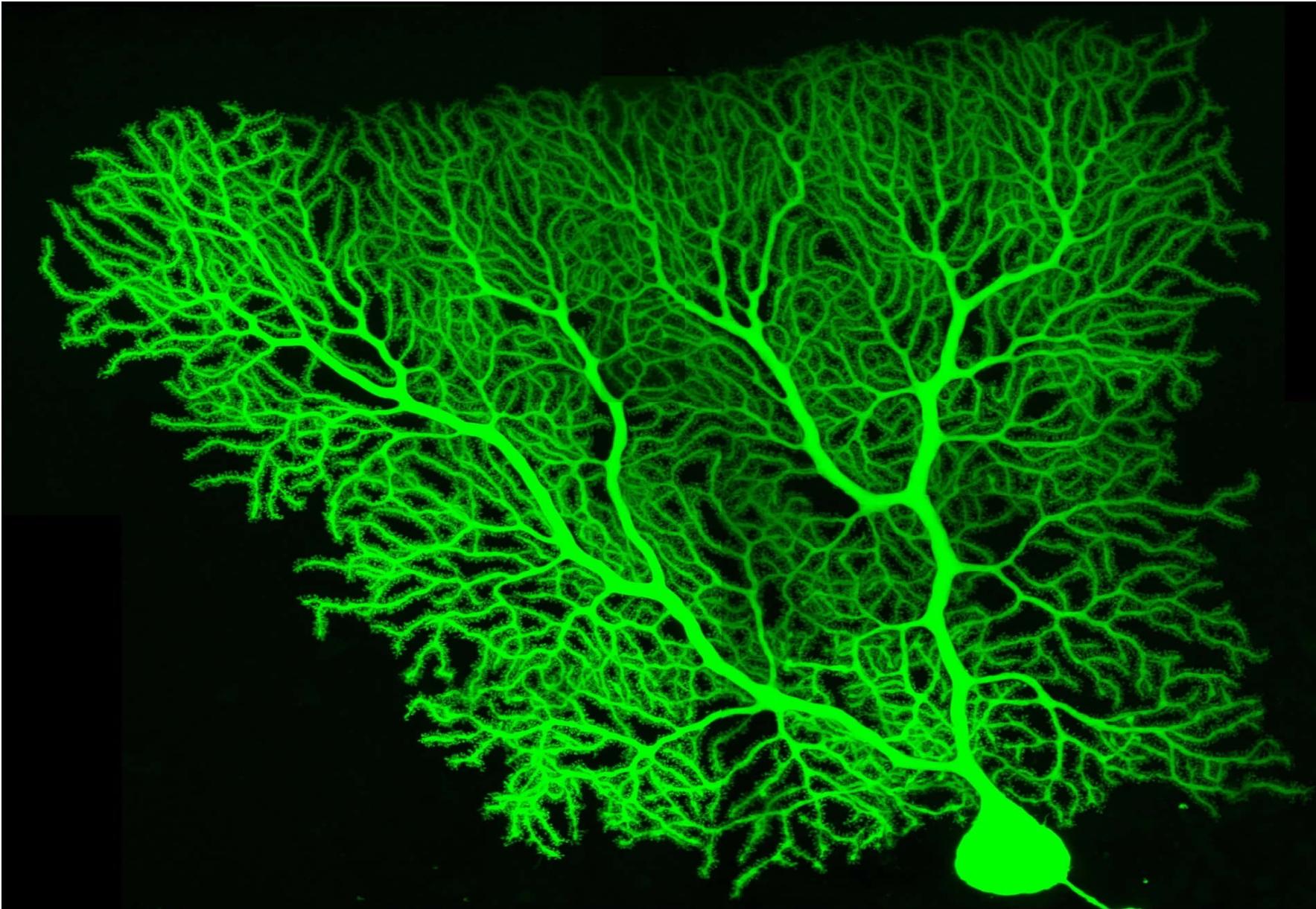


- The middle layer of the cerebellar cortex. formed of one type of cells (Purkinje cell)
- **Site:** These are large cells, arranged uniformly in a single plane along the upper margin of granular layer.
- **Cell body:** Each cell has a large flask-shaped cell body. It has a vesicular central nucleus and coarse cytoplasmic Nissl's granules.



Dendrites:

- Form an elaborate fan-like dendritic tree, at right angles to the long axis of the surface.
- These dendrites branch to give rise to primary, secondary and tertiary branches.
- Primary and secondary branches are smooth, while the tertiary branches show spines.

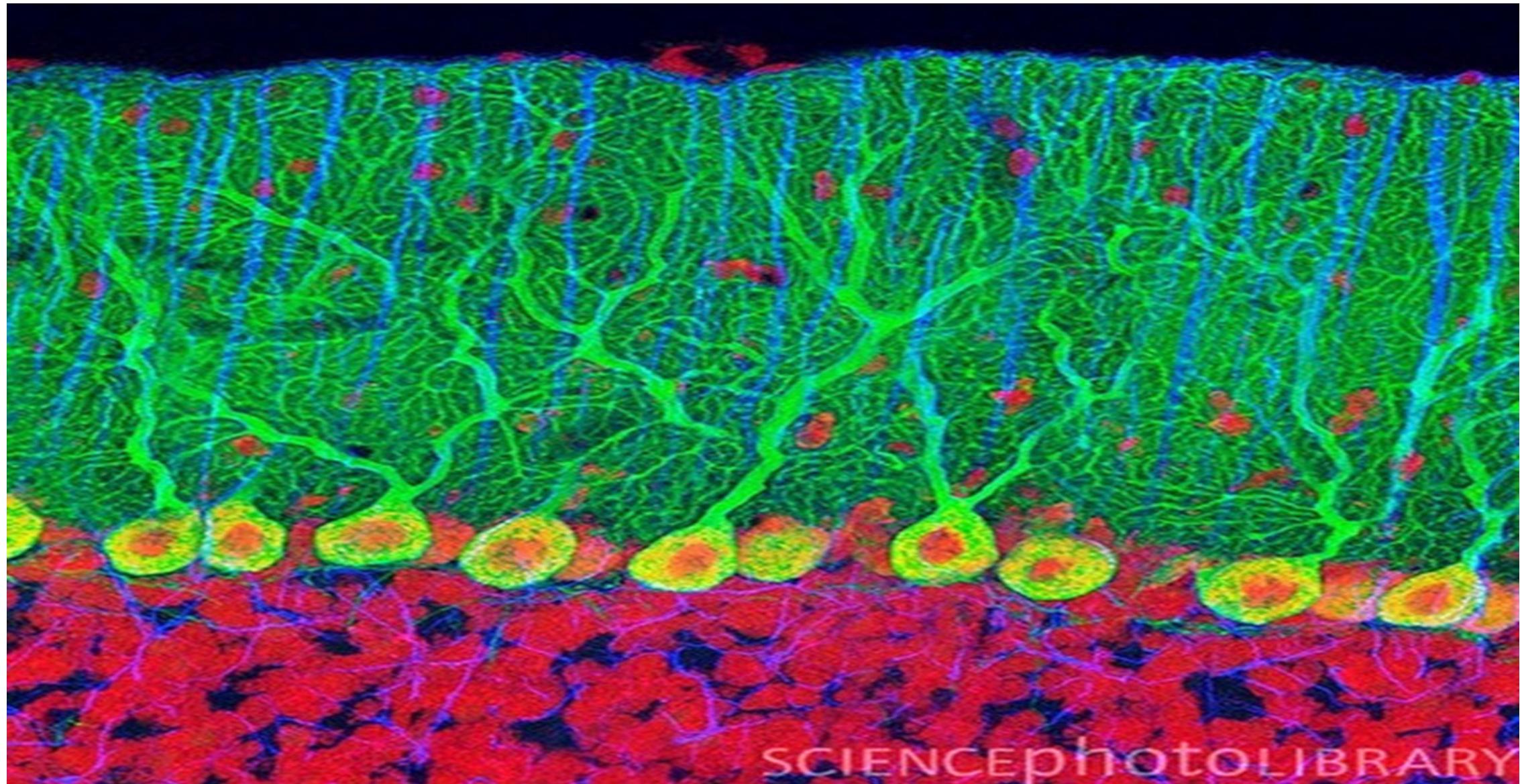


<https://ntls.co/images/NTLS/blog/purkinjecells.jpg>

Purkinje Cell layer



- **Axons:**
 - They represent the efferent pathway from the cortex.
 - Myelinated passing through the granular layer and white matter to synapse with deep cerebellar nuclei. (Some axons bypass the deep cerebellar nuclei and leave the cerebellum to reach the vestibular nuclei).
 - They give collaterals that synapse with Golgi type II and basket cells.



SCIENCEphotOLIBRARY

Granular layer



- Formed of closely packed cells separated by non cellular spaces called **cerebellar islands (Glomerulus)**.
- There are two types of cells:

Granular layer



| Golgi type II Cells | Granule Cells | |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Found in the upper parts of the granular layer | Small cells having large rounded nuclei and thin rim of cytoplasm with few Nissl's bodies | Cell body |
| Extend in all layers of the cortex | Show claw like endings that terminate in the glomerulus | Dendrites |
| End within the cerebellar glomeruli | Their axons ascend to the molecular layer, where they bifurcate to give rise to parallel fibers that synapse with dendrites of Purkinje | Axons |

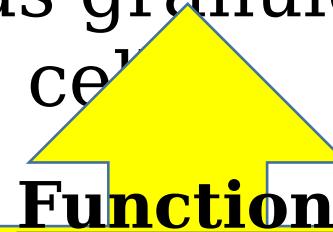
Granular layer



Cerebellar islands (Glomeruli):

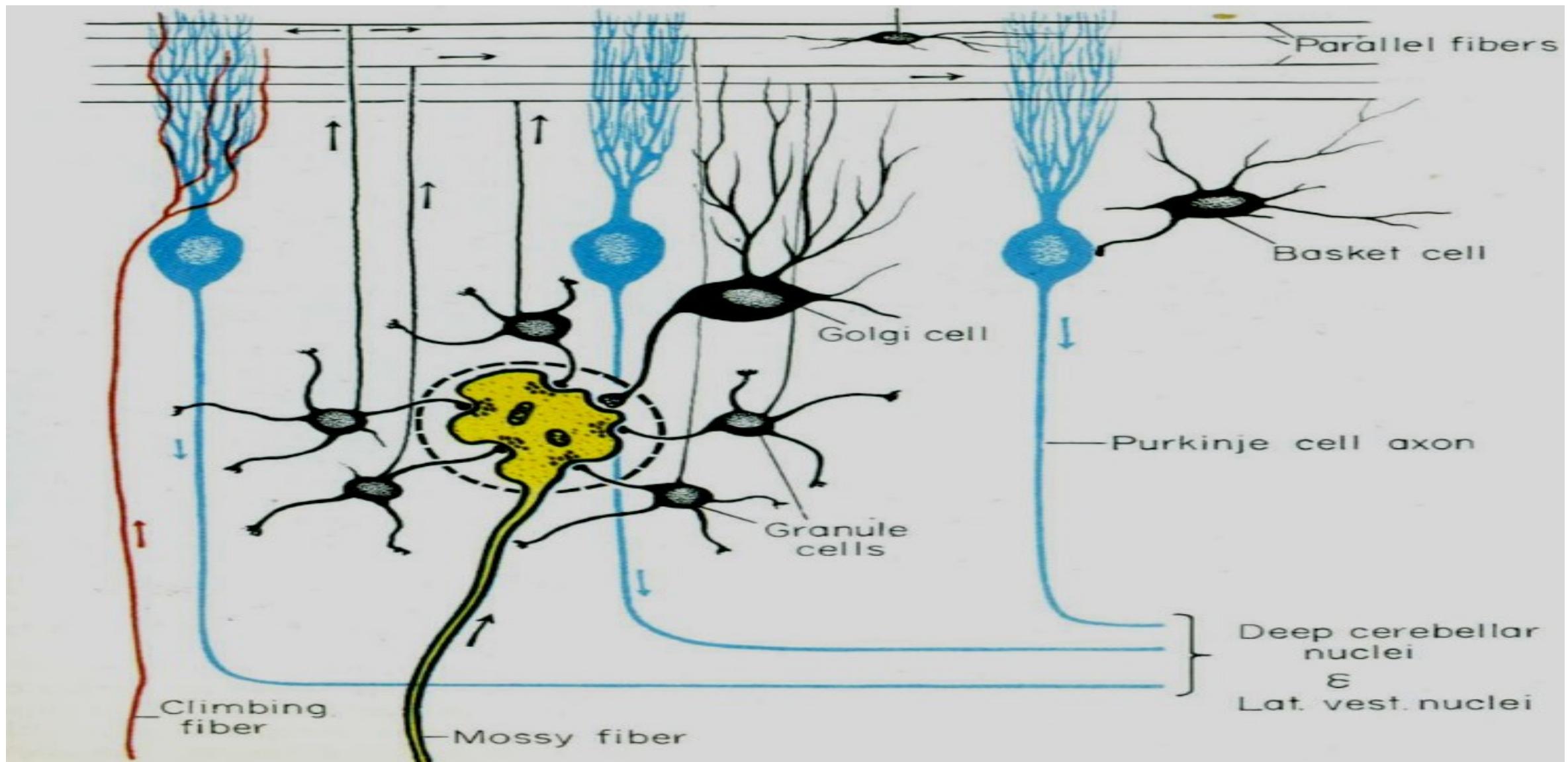
These are irregularly dispersed pale non cellular areas, composed of a complex synaptic structure formed of:

- 1) Mossy fiber terminal .
- 2) Dendrites of numerous granule cells.
- 3) Axons of Golgi type II cells



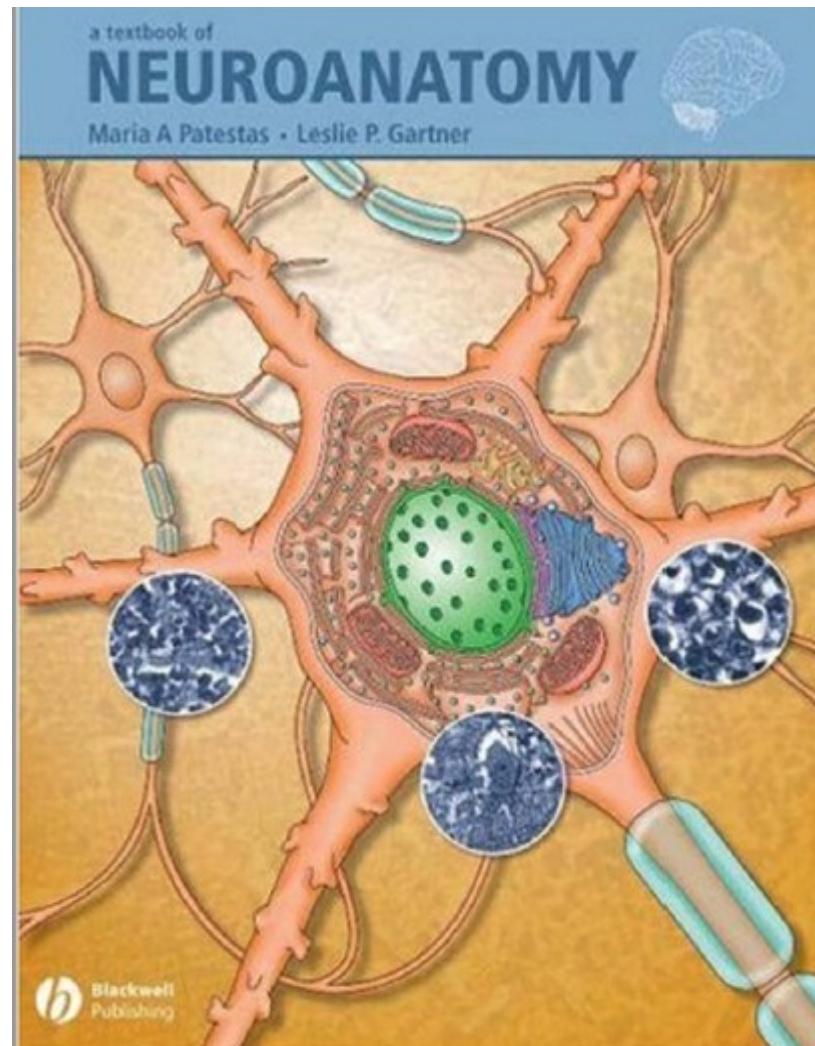
Mossy fibers excite the granular cells which in turn excite purkinje cells through axons of granule cells (unmyelinated fibers),that ascend vertically to the molecular layer and synapses with Purkinje cell dendrites.

Granule cells are the only excitatory neurons in the cerebellar cortex.



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Suggested Textbooks





THANK YOU